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Calculation and application of departmental burden rates

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NATIONAL ASSOCIATION
of
COST ACCOUNTANTS

2

Official Publications

Vol. 1

APRIL 1920

No. 3

Calculation and Application of
Departmental Burden Rates

WOOLWORTH BUILDING
233 BROADWAY NEW YORK CITY

NATIONAL ASSOCIATION
of
COST ACCOUNTANTS

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Departmental Burden Rates

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NATIONAL ASSOCIATION OF COST ACCOUNTANTS

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April 1920

Calculation and Application of Departmental Burden Rates

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WOOLWORTH BUILDING

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National Association of Cost Accountants

CALCULATION AND APPLICATION OF DEPARTMENTAL BURDEN RATES

BURDEN SUBJECT TO SCIENTIFIC CALCULATION AND CONTROL

No feature of cost accounting is more difficult than burden distribution. Burden, however, can be calculated with a surprising degree of accuracy and can be scientifically controlled through the medium of departmental burden rates together with departmental burden and expense accounts. The impression is too widespread that burden is extremely elusive. Cost accountants can do a great deal to counteract this false impression by taking advantage of every opportunity to explain the modern methods of distributing burden.

A brief survey of the more important steps in the evolution of burden distribution will make it easier to understand the modern practice. It should be clearly borne in mind that in the following discussion a job-cost system is used as a basis of illustration.

EVOLUTION OF BURDEN DISTRIBUTION

FIXED PERCENTAGE METHOD.

What was probably the first method of distributing burden was very arbitrary and for that reason very inaccurate. This was known as the fixed percentage method. Under this plan manufacturing cost was found by adding, usually to the prime cost, a fixed percentage to cover manufacturing burden. To manufacturing cost was added another fixed percentage to cover selling and administrative burden. The addition to this cost figure of further percentages for profit furnished the figures for the arbitrary fixing of selling prices.

BLANKET RATE METHOD.

The next step in burden distribution which increased somewhat the accuracy of burden incidence was the use of blanket rates. At the beginning of each fiscal period blanket rates were calculated for the period. These rates were based on past or estimated figures for the *whole plant*. The following were some of the bases used for burden calculation and application under this plan:

1. Material Costs.
2. Direct-Labor Costs.
3. Prime Costs.
4. Direct-Labor Hours.
5. Machine Hours.

The burden basis was divided into the total manufacturing burden of the whole plant for a past or future period to give the *blanket burden rate*. Under this method, therefore, burden rates were not ascertained for each direct (productive) department. By way of illustration consider a case where the total manufacturing burden and total direct-labor hours were \$25,000 and 50,000 respectively. In this case the burden rate would be:

$$\frac{\$25,000}{50,000} = .50 \text{ per direct-labor hour.}$$

This rate was then applied during the current period as follows: Suppose a job whose prime cost was \$30.00 consumed 20 direct-labor hours. Its burden cost would be: $20 \times \$0.50 = \10.00 . The cost of the job summarized would be:

Prime Cost	\$30.00
Burden Cost	10.00
	<hr/>
Total Manufacturing Cost.....	\$40.00

Both fixed percentages and blanket rates were open to serious objection. Neither method considered differences in equipment, machine hours, labor hours and labor costs which caused burden to vary among departments. Both methods ignored the fact that departments were the natural units for the calculation and application of burden.

STEPS IN THE CALCULATION AND APPLICATION OF DEPARTMENTAL BURDEN RATES

The next step in the evolution of burden distribution was the use of departmental burden rates. This method is generally regarded today as the best method of applying burden to product. The steps involved in the calculation and application of departmental burden rates and in the preparation of Burden Statements (see form on page 8) may be summarized as follows:

1. Selecting equitable bases for the distribution of current burden incurred to direct (productive), indirect (non-productive) and miscellaneous departments.¹
2. Current charging of actual burden incurred to direct, indirect and miscellaneous departments.
3. Current closing of actual burden incurred by indirect and miscellaneous departments into Department Burden Accounts for each direct department.
4. Predetermining standard departmental burden rates.
5. Applying standard departmental burden rates.
6. Preparing monthly Burden Statements.
7. Recording the differences between actual burden and applied burden under the caption "Balance Carried to Plant Burden Balances" in Department Burden Statements.
8. Transferring Plant Burden Balance of each department to a summary statement showing Plant Burden Balances of all departments.
9. Recording net result of this summary statement in the current Profit and Loss Statement before net manufacturing profit is ascertained.
10. Preparing journal entries to charge the total applied burden of each direct department to Work in Process Burden accounts; and to charge the individual jobs with their portion, the corresponding credit being made to the department burden accounts or to department credit accounts as explained below.
11. Preparing Burden Statements which show monthly comparisons of burden.²
12. Adjusting departmental burden rates when standard rates are no longer applicable to current conditions.

¹Some of these bases will be discussed in greater detail in a later article by the writer.

²Some of these steps will be discussed in this article while others will be treated in greater detail in a subsequent publication.

DEPARTMENTAL BURDEN ACCOUNTS

All manufacturing burden must ultimately be collected in departmental burden accounts for direct departments. Although some burden costs may be originally charged to indirect and miscellaneous departments, they are later cleared into direct departmental burden accounts and are added to the burden costs originally charged to such accounts.

RELATION OF TERMS—EXPENSE, BURDEN AND OVERHEAD

One of the difficulties in discussing all cost problems, including the one under consideration, is the lack of a standardized cost terminology. Many terms in common use have never been given established definitions which are generally accepted. The following distinctions between expense, burden and overhead have the merit of clearness although they are not always adhered to in present day practice.¹ The term expense might be applied to cost items (other than prime cost) when they are charged to expense accounts such as teaming expense and engineering expense. These accounts are split up and distributed ultimately to various departmental burden accounts. Expense accounts may first be closed into accounts which accumulate the expenses of indirect and miscellaneous departments. These accounts, in turn, along with "apportioned" expenses such as steam, electric power, compressed air and general expense, are ultimately closed into departmental burden accounts. As stated above, a departmental burden account is kept for each direct department. The term burden, therefore, would be used in connection with each account that accumulates all costs (other than prime costs) for each direct department. The term overhead would be reserved to indicate the fact that costs (other than prime costs) are "over" the product which passes through the shop and must be applied to the product before its final manufacturing cost can be calculated. If these distinctions between the terms expense, burden and overhead are held in mind, the technique of burden distribution will be more easily understood.

¹In connection with the work of the Committee on Standardization, we should like to have expressions of opinion from members on the definitions mentioned in this paragraph.

PREDETERMINATION OF STANDARD DEPARTMENTAL BURDEN RATES

Before discussing the application of burden, let us consider the calculation of burden. The survey of a plant made by the cost accountant prior to the installation of a cost system may disclose that the plant is not departmentalized as well as it might be. If such a condition exists, proper departmentalization ought to precede the calculation and application of burden rates because burden is assembled by direct departments. The survey may bring to light also the fact that a proper division of expense accounts does not exist and that equitable bases for distributing expenses are not used. Those conditions like improper departmentalization should be corrected before burden can be scientifically applied and controlled. If the firm does not have correct departmental burden rates, then rates should be based either on past standard burden or on current burden during a period of sufficient duration to indicate what the standard burden is. Burden rates, therefore, are predetermined, i. e., averaged or estimated in advance of a fiscal period. Then they are applied during current periods. Burden rates should be standard or normal; that is, they should be based on burden costs which occur when production is standard or normal. It is not always an easy matter to determine standard production because it varies in different industries and in different plants in the same industry. A serviceable figure, however, is that production which is turned out when a plant runs 80 to 90 per cent. of its capacity. It is obviously unfair to use burden rates based on a single month's actual burden unless such burden is typical of the whole year. This is seldom the case. For example, the repairs made to an open-hearth furnace in a steel plant may be unusually high one month and very low the next. It would be both unfair and inaccurate to charge the product of the first month with a high burden rate and the product of the second month with a low burden rate, because neither rate would be standard. Furthermore, proper selling prices cannot be fixed without standard burden rates. After the standard burden (money amount) for a direct department has been ascertained, it is divided by some base such as normal direct-labor hours, or normal machine hours, or normal direct-labor cost—whichever basis best fits the conditions—in order to arrive at the predeter-

THE A. B. C. CORPORATION

Department No. 1

BURDEN STATEMENT

Month of January, 1920

	Other Dept. Labor	Own Labor	Material & Miscel.	Mo. Total	Last Mo. Total
Burden Labor:					
1—Foremen and Assistants					
2—Inspection Expense.....					
3—Timekeepers, Tool Cribs..					
4—Cleaning and Sweeping....					
5—Oiling Shafting					
6—Handling Product.....					
7—Work a/c Shop Errors.....					
8—General Labor.....					
9—Idle Time.....					
10—Attendance Bonus.....					
13—War Bonus					
Total	00000.00	0000.00	0000.00	0000.00	00000.00

Cost per Productive Hour.....

Maintenance and Supplies:

15—Maint. of Machinery.....					
16— “ “ Shafting, Pul- leys, Hangers..					
17— “ “ Belts					
18— “ “ Electr. App.....					
19— “ “ Water, Air Power Lines....					
20— “ “ Furnace					
21—					
22—Other Maintenance					
23—Maintenance of Fixtures..					
24—					
25—Dies					
26—Hobs					
27—Mills and Drills.....					
28—Files					
29—Steel Stamps.....					
30—Other Non-Durable Tools					
31—Emery Wheels					
32—Lub. and Cutting Oils.....					
33—Electric Lamps.....					
34—Gas					
35—Fuel Oil					
36—Other Fuel.....					
37—Miscel. Shop Supplies.....					
38—Welding Material.....					
39—Hardening Supplies.....					
40—Soda					
Total	00000.00	0000.00	0000.00	0000.00	00000.00

Cost per Productive Hour.....

Forward	00000.00	0000.00	0000.00	0000.00	00000.00
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Department No. 1
BURDEN STATEMENT

Month of January, 1920

	Other Dept. Labor	Own Labor	Material & Miscel.	Mo. Total	Last Mo. Total
Forward	00000.00	0000.00	0000.00	0000.00	00000.00
Proportioned Charges:					
Prop. of Div. Expense.....					
" " " Labor.....					
" " Elec. Power Exp.					
" " Steam Exp.....					
" " Compressed Air					
" " Exp.....					
" " Liability Insur-					
ance.....					
Total				0000.00	00000.00
Cost per Productive Hour					
Total Burden				0000.00	00000.00
Less Carried to Work in					
Process Burden 00,000					
Productive Hours at .000					
per hour.....				0000.00	0000.00
Balance Carried to Plant					
Burden Balances.....				0000.00	0000.00

COMPARATIVE COST PER PRODUCTIVE HOUR

	Prod. Hours		Burden		Cost per Hour	
	For Mo.	Total	For Mo.	Total	For Mo.	Average
January	0000.00	00000.00	00000.00	00000.00	000.00	000.00
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						

mined burden rate for the department under consideration. Note that this rate is predetermined. Actual burden rates could not be calculated until the end of each cost period. If actual rates were used, however, product completed before the end of the period could not be costed until the close of the period. Thus, one desideratum of cost accounting, namely, prompt compilation and presentation, would be lost if actual rather than predetermined burden rates were used.

THEORY OF BURDEN CALCULATION

The general theory underlying the calculation of departmental burden rates is that a proportional relationship exists between the burden of each department and some basis. The major problem, therefore, is to select the basis best suited to existing conditions. The same basis is not necessarily used for all departments. The most satisfactory bases for the calculation of departmental burden rates are:

1. Direct-labor Hours.
2. Machine Hours.
3. Direct-labor Cost.

For the sake of illustration only one basis, namely, direct-labor hours, will be explained. Usually it is the best basis. It has been ascertained, let us say, that the standard manufacturing burden and the standard direct-labor hours in Department A have been \$30,000 and 60,000 hours, respectively. The former divided by the latter would give \$0.50 per direct-labor hour, which is the departmental burden rate.

APPLICATION OF DEPARTMENTAL BURDEN RATES

After standard burden rates are predetermined for each direct department, they are applied to the product which passes through such department during the cost period. The number of direct-labor hours or machine hours, or the direct-labor cost—whichever burden basis is used—of each job in each direct department is multiplied by the burden rate of that department. This process is

repeated for each department through which the job passes to give the applied burden costs. The detailed burden costs are entered on cost sheets for individual parts and assemblies, as the case may be. The total of applied burden is charged to Work in Process Burden accounts¹ and credited to Departmental Burden Credit accounts. Actual burden incurred during the period is distributed to Departmental Burden accounts in order to ascertain any difference between actual burden and applied burden. The treatment of these differences will be explained later.

CONTENTS OF BURDEN ACCOUNT

The following is a summary of what the illustrative departmental burden statement on page 8 shows:

1. Actual burden incurred.
 - a. Burden labor (details).
 - b. Burden labor (totals).
 - c. Maintenance and supplies (details).
 - d. Maintenance and supplies (totals).
 - e. Proportioned charges (details).
 - f. Proportioned charges (totals).
 - g. Total burden.
2. Applied burden.
3. Difference between actual burden and burden applied through departmental burden rate.
4. Comparative table.

Actual burden charged during the period is entered in either the "Other Department Labor," "Own Labor," or "Material and Miscellaneous" columns, as the case may be. Indirect labor on work, plus burden on same, performed for department No. 1 by indirect workers of other departments is entered in the "Other Department Labor" column. The department's own indirect labor on

¹In modern cost systems it is sometimes advisable to open three work in process accounts, namely:

Work in Process Material
Work in Process Labor
Work in Process Burden

Frequently, however, only work in process account is used.

work done in the department is entered in the "Own Labor" column. Indirect material and miscellaneous charges are recorded in the "Material and Miscellaneous" column. The individual items in these three columns are totaled at the bottom of the "Burden Labor" section. The individual items in the three above columns are cross-totaled and the sums are recorded in the "Monthly Total" column. The totals of the items for last month are entered for comparative purposes. The same general procedure is followed in filling out the "Maintenance and Supplies" and the "Proportioned Charges" sections. Then the total burden for the three big sections of the statement is calculated. The next step is to find the total of direct-labor hours (since this is the burden basis used in the sample statement) on all work in this department for the period. This figure is multiplied by the predetermined departmental burden rate based on direct-labor hours to give the applied burden which is charged to Work in Process Burden account and credited to the Burden Credit account kept for this department.

A question may arise as to the reason for using a burden credit account for each departmental burden account instead of crediting the latter itself with applied burden. The best reason in the writer's opinion is that the use of burden credit accounts insures the accumulation of totals throughout the year, thereby facilitating the prompt preparation of statements. If, when we charged Work in Process Burden account, we credited Departmental Burden account with the applied burden of the department, only a net balance for the month would remain in the latter account. After the repetition of this process monthly throughout the year, the preparation of a progressive statement for the year is troublesome. Another advantage of burden credit accounts is that they follow each other and accumulated totals can be shown when a trial balance is prepared. If applied burden were credited to departmental burden accounts, extensive analysis of these accounts would be required before the firm could ascertain how actual burden and applied burden were running month by month.

It should be noted, however, that no ledger accounts are opened to record plant burden balances shown in departmental burden statements to indicate the difference between actual burden and applied burden. Furthermore, these plant burden balances

are too numerous to be entered in the Profit and Loss Statement. Hence they are arranged in a supplementary schedule which is keyed into the Profit and Loss Statement by a designating symbol. The net result of all plant burden balances is entered as a single amount in the manufacturing section of the Profit and Loss Statement before net manufacturing profit is ascertained.

COMPARATIVE COST PER PRODUCTIVE HOUR

The "Comparative Cost Per Productive Hour" shown on the departmental burden statement is a summarized table which shows (1) productive-labor hours, (2) total burden cost, and (3) burden cost per productive-labor hour. In the "For Month" column, under Productive Hours, is entered the productive-labor hours applicable to all work in the department for the month. The February figure added to the January figure, for example, would give the amount to be entered in the "Total" Column opposite February. To this total figure would be added the productive-labor hours for March and the result would likewise be entered in the Total Column opposite March, and so on. In other words, the total column is a running total column. The same general procedure is followed for the Burden columns.

The monthly costs, divided by the productive-labor hours for the month, gives the *actual burden cost rate per hour* for the month. The average burden cost (rate) per hour is figured every month for all months to date. The data in this table is necessary in making intelligent decisions as to whether or not burden rates should be revised.

REVISION OF DEPARTMENTAL BURDEN RATES

By the use of departmental burden accounts and burden credit accounts actual burden can be readily compared with applied burden. Any differences will be small if care is observed in setting standard departmental burden rates. The writer has in mind, for example, a plant with an actual burden of \$2,000,000 and plant burden balances of only \$12,000 for the year. In other words, the undistributed burden for the year was only $\frac{3}{5}$ of 1 per cent., which shows what can be done with scientific control of burden.

If plant burden balances are large and liable to continue so, the burden rates should be revised to fit the changed conditions. Otherwise, current costs will be inaccurate. Burden balances may be due, among other things, to changes in the volume of production and burden costs; and to idle machinery and equipment, and the like.

NOTE IN REGARD TO SUBSEQUENT ARTICLES

The chief purposes of the foregoing article are (1) to overcome the impression, which is too general, that burden is not subject to scientific calculation and control; and (2) to outline rather broadly all of the steps involved in the calculation and application of departmental burden rates, and in the preparation of burden statements. In subsequent issues of the "Official Publications" of the National Association of Cost Accountants, additional points, such as the following, will be taken up in detail:

1. Expense Debit Slip.
2. Selection of equitable bases for the distribution of current items of burden incurred to direct, indirect and miscellaneous departments, such as:
 - a. Rent.
 - b. Fire and Liability Insurance.
 - c. Heat, Light and Power.
 - d. Wages of Foremen and Superintendents.
 - e. Telephone and Telegraph.
 - f. Trucking Expense.
 - g. General Expense.
3. Preparation of Burden Statements with illustrations.
4. Preparation of Plant Burden Balances Statement with illustrations.
5. Sample journal entries showing distribution of burden.
6. Sample statement showing monthly comparison of burden.